

Injury-Related Medical Care Utilization in a Problem Drinking Population

ABSTRACT

Background. Population-based data on the overall risk of injury among problem drinkers are extremely limited.

Methods. We conducted an eight-year study of injury-related medical care utilization for a group of problem drinkers ($n = 3\,729$) enrolled in the health insurance plan of a large manufacturing firm with plants in a number of midwestern states. A comparison non-problem drinking cohort matched on age, gender, and number of years of enrollment with the same company plan was also utilized.

Results. Problem drinkers utilized injury-related medical care at a rate 1.6 times that of the comparison group and experienced injury-related medical care costs which were three times as high. Increased risks were found for both men and women and for all ages studied.

Conclusions. This study is one of the few to examine the overall incidence of fatal and non-fatal injuries among a large population of problem drinkers and provides evidence that higher medical care costs are associated with chronic alcohol use. (*Am J Public Health* 1991;81:1571-1575)

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Introduction

The role of injuries as a public health problem and as a contributor to medical care costs among the general population has seen increasing attention.^{1,2} The association of alcohol use with accident and injury has also been the subject of frequent investigation. Yet there is surprisingly little epidemiological data regarding the overall risk of injury—and the attendant utilization of medical care—among alcoholics and problem drinkers.

A considerable body of research has examined the relationship between alcohol use and fatal injuries. (See reviews by Smith and Kraus,³ Howland and Hingson,^{4,5} Hingson and Howland.⁶) The association between alcohol and traffic fatalities has received particular scrutiny.^{7,8} On the whole, this research suggests that there is indeed a link between alcohol and fatal injury, although the actual magnitude of the risk cannot be estimated with great precision.

Fatal injuries, however, constitute only a small portion of all injuries.^{2,9} The connection between alcohol and nonfatal injuries has received much less attention. Most research on nonfatal injuries focuses solely on traffic accidents.^{10,11} Other studies of nonfatal injuries (i.e. those not limited to traffic accidents) are entirely event based—that is, they are based on the analysis of data from accident victims presenting themselves for care at specific facilities such as emergency rooms.¹²⁻¹⁷

While these event-based studies provide important data on the association between drinking and injury, they provide us with little information on the overall incidence of nonfatal injuries among problem drinkers as a group. Roizen¹⁸ reviewed the literature through 1979 and

found no studies on nonfatal accidents (other than traffic accidents) which were based on populations of problem drinkers or alcoholics. Our review of the more recent literature has likewise revealed no such studies.

Several national studies of self-reported alcohol-related problems have been published (e.g. Hilton and Clark¹⁹). The single survey-based study reporting specific data on nonfatal injuries (Hingson, *et al.*²⁰) found that high levels of typical alcohol consumption were associated with a higher level of accidental injury in employee populations in four New England states. Such surveys, however, cannot identify diagnosed problem drinkers and alcoholics.

Methods

This study derives estimates of the incidence of medical care utilization due to injury for a problem drinking population. Health insurance claims and enrollment data from a large midwestern manufacturing corporation were analyzed for the years 1974 through 1987. The data base included approximately 20 million health care claims filed by the 260,000 enrollees covered during the 14-year period.

For the 1980-87 period over which ICD-9 (International Classification of Diseases, 9th Revision) codes were available, 3,729 individuals received a diagnosis in-

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TABLE 1—Injury-related Medical Care: Average Annual Number of Events, Cost and Inpatient Days for Problem-drinking Group and Matched Group

Number of Injury-Related Medical Care Events	Problem Drinkers N = 3729	Matches N = 3729	P Value ^a	Risk Estimate ^b
All events	1.32 (±.08)	.76 (±.06)	.002	1.74
Inpatient admissions	.04 (±.004)	.01 (±.002)	.001	4.00
Outpatient visits	1.05 (±.07)	.65 (±.06)	.002	1.62
Emergency room admissions	.23 (±.01)	.10 (±.01)	.001	2.30
Total Cost of All Injury-Related Medical Care Events ^c	\$250 (±26)	\$82 (±11)	<.001	3.05
Average Number of Injury-Related Inpatient Days	.32 (±.03)	.08 (±.04)	<.001	4.00

Annual averages per person, 95% confidence intervals in parentheses.
^aBased on T test.
^bRatio of observed to expected.
^cDecember 1985 dollars.

dicating a chronic drinking problem.* A group of non-problem drinking individuals, i.e. individuals who had never received a diagnosis indicating a chronic drinking problem, was selected from the total enrollee population. These individuals were matched on a one-to-one basis with members of the problem drinker group on age, gender, and the number of years enrolled. The average age of both groups was 38.6 years of age; 75.5 percent of each group was male.

Coverage under the company's broad health insurance policy was quite stable due to the largely unionized nature of the workforce and to the fact that the company's program was self-insured and administered throughout the 14-year period. Company-sponsored HMO options were established in the early 1980s, with benefit provisions similar to the fee-for-service plans. Utilization records for the two major HMOs were available while records for a third HMO were not. Further details on the company's insurance coverage and data base are described elsewhere.**

*The following ICD-9 codes were used²¹:

- 291 —alcoholic psychoses
- 303 —alcohol dependence syndrome
- 305.0—alcohol abuse
- 357.5—alcoholic polyneuropathy
- 425.5—alcoholic cardiomyopathy
- 535.3—alcoholic gastritis
- 571 —chronic liver disease and cirrhosis
- 572.3—portal hypertension

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The diagnosis codes from the Clinical Modification of the 9th Revision of the International Classification of Diseases²¹ were used to classify events as injury-related or non injury-related. Events carrying a diagnosis of 800–995 (the injury and poisoning grouping) were classified as injury-related. The supplementary codes for classification of external causes of injury and poisoning were not available. Among the problem drinking group, 9.1 percent also exhibited evidence of the abuse of other drugs—ICD-9 diagnoses of drug psychoses (292), drug dependence (304), or drug abuse (305.2–305.9).

For the two study populations (total N = 7,458) over 50,000 injury-related medical care events (admissions and/or visits) were identified during the 1980–87 period. Measures were developed for inpatient, outpatient, and emergency room events. Each visit or admission was considered a separate event. The actual number of unique injuries cannot be ascertained from the data, nor can events related to fatal and nonfatal injuries be readily distinguished. No data were available on whether drinking immediately preceded a given event.

Data were also available on the total cost (defined as total charges) for injury-related medical care events. The Medical Care Index (US Department of Labor) was used to adjust all dollar values (reported in December 1985 dollars) for inflation.

All annual averages were calculated based upon the number of months of enrollment (months of exposure) for each individual. Individuals who switched into the HMO plan for which data were not

available were considered to have lost their enrollment eligibility at that point. On average, 49 percent of all injury-related medical care events occurred prior to the initial problem-drinking diagnosis, while 51 percent occurred afterward. The average length of enrollment was about six years, approximately equally divided into pre- and post-diagnosis periods.

One class of injuries is underrepresented in the data base. On-site medical staff at major company worksites generally provide medical care for minor on-the-job injuries. No insurance claims are filed if all care is provided on site by company medical personnel. Medical care for work injury was included in our data only if off-site medical services were used.

Selection bias could occur if the manner in which study group members are chosen has a differential impact on the dependent measures for the two groups. Selection into the problem-drinking group is dependent on receiving a specific chronic disease diagnosis while membership in the control group is not. Since the dependent measures used for both groups included injury-related medical care only, selection bias is most likely if a chronic drinking diagnosis is directly associated with an injury-related event. However, only 7 percent of all problem drinkers received any injury-related medical care in the month preceding their initial problem-drinking diagnosis. Thus, there is no evidence that a significant selection bias exists for the study groups used in the analyses reported here.

Results

Table 1 presents the average incidence rates for injury-related medical care events over the 1980–87 period. Problem drinkers averaged 1.32 medical care events per year compared to only .76 per year for those with no chronic drinking diagnosis. The difference between the two groups is especially pronounced for events involving hospitalization. For both groups, injury-related outpatient care events far outnumber emergency room and inpatient admissions. The problem-drinking group also experienced significantly higher injury-related medical costs than did their matched cohort—an average of \$250 per year compared to \$82. The number of injury-related inpatient days (number of days of hospitalization due to injury) was .32 and .08 per year for the two groups, respectively.

The incidence of injury-related medical care utilization among problem drinkers exceeds the incidence for matches for all

demographic subgroups examined (Table 2). All differences were statistically significant. Males have much higher injury care rates than females in both groups. The highest injury rates occurred among those ages 31–50, while those age 51 and over showed comparatively low rates of injury.

Both male and female problem drinkers incur annual injury-related medical care costs which are three times the cost of their matches (Table 3). For all subgroups, the risk estimates for costs (Table 3) exceed those for total injury events (Table 2). This may be due to a higher incidence of severe injuries among problem drinkers or to variations in the type of injury. No data are available on these factors.

Adjusting for Demographic Differences between Groups

While the problem drinker and non-problem drinker groups are matched on age, gender, and length of enrollment, other demographic differences between the groups exist (see Table 4). Analysis of variance was used to control for the impact of these demographic factors on the total number of injury-related medical care events. Demographic control variables include GENDER, AGE (30 and under, 31–50, and 51 and over); work class (WORKCL), whether an individual is a salaried or hourly employee; PERSTYPE (i.e. whether an individual is an employee, spouse, child); insurance plan type (PLANTYPE). GROUP denotes whether an individual is in the problem drinking or matched group. All independent variables except gender were statistically significant and were thus included in the final model (Table 5). No interaction terms were statistically significant. The model indicates that after the impact of demographic variables is considered, the difference in injury-related medical care utilization between problem drinkers and matches is still statistically significant ($p = .002$).

Overall, the adjusted level of injury-related medical care events for problem drinkers is 1.6 times what would otherwise be expected (Table 6). While female problem drinkers experience a lower overall level of injury-related care utilization than males, their relative risk is somewhat higher (1.91 vs 1.54). Similarly, problem drinkers over age 51 experience the lowest incidence but the highest relative risk (2.12).

Discussion

This is a unique population-based study comparing overall injury rates among

	Problem Drinkers	Matches	P Value ^a	Risk Estimate ^b
<i>Gender</i>				
Male	1.46 (±.09)	.82 (±.07)	<.001	1.78
Female	.88 (±.13)	.58 (±.14)	.002	1.52
<i>Age (years)</i>				
30 and under	1.34 (±.12)	.65 (±.08)	<.001	2.06
31–50	1.62 (±.15)	.96 (±.11)	<.001	1.69
51+	.75 (±.10)	.57 (±.08)	.023	1.32

95% confidence intervals in parentheses.
^aT test.
^bRatio of observed to expected.

	Problem Drinkers	Matches	P Value ^b	Risk Estimate ^c
<i>Gender</i>				
Male	\$263 (±30)	\$86 (±13)	<.001	3.06
Female	\$210 (±50)	\$67 (±17)	<.001	3.13
<i>Age (years)</i>				
30 and under	\$255 (±40)	\$67 (±13)	<.001	3.81
31–50	\$248 (±39)	\$74 (±10)	<.001	3.35
51+	\$247 (±62)	\$116 (±36)	<.001	2.13

95% confidence intervals in parentheses.
^aDecember 1985 dollars.
^bT test
^cRatio of observed to expected.

	Problem Drinkers	Matches
Person Type (PERSTYPE)		
% employee	61.3	56.0
% spouse	18.7	23.2
% child	19.9	20.8
Work Class (WORKCL) ^a		
% hourly	80.8	62.2
% salaried	19.2	37.8
Insurance Plan Type (PLANTYPE)		
% traditional only	53.6	43.8
% HMO only	-0-	.2
% traditional/HMO ^b	46.4	56.0

^aIndividuals who are not company employees are classified according to the work class of the employed family member.
^bSwitched into HMO from traditional fee-for-service plan.

problem drinkers and a matched age and gender cohort. During the eight-year period from 1980–87, the average number of injury-related medical care events per year for over 3,700 problem drinkers exceeded that for the matched group for both males and females and for all age groups. Relative risk estimates range from 1.54 for males to 2.12 for those age 51 and over, based on an

analysis of variance model which adjusts for differences due to person type, work class, and insurance plan type. These findings provide clear evidence that the number of medical care events due to injury is significantly higher for problem drinkers than for demographically similar individuals who do not have a known history of problem drinking.

TABLE 5—Final Analysis of Variance Model

	Sum of Squares	DF	Mean Square	F Ratio	P
GROUP	318.84	1	318.84	65.48	.002
AGE	519.33	2	259.66	53.32	<.001
PERSTYPE	739.39	2	369.70	75.92	.003
WORKCL	164.03	1	164.03	33.69	.002
PLANTYPE	30.24	2	15.12	3.11	.025
Error	34919.54	7171	4.87		

TABLE 6—Number of Injury-related Medical Care Events for Problem Drinkers—Adjusted Annual Means^a and Risk Estimates^b

	Problem Drinker Group	Matched Group	Risk Estimate
All individuals	1.32	.82	1.61
Males	1.42	.92	1.54
Females	1.01	.53	1.91
Age (years)			
30 and under	1.29	.78	1.65
31–50	1.58	1.07	1.48
51+	.91	.43	2.12

^aAdjusted mean number of injury-related medical care events per year, based on ANOVA results.
^bRatio of observed to expected.

This study could not provide direct information on the actual risk of injuries among problem drinkers since the data contained information only on medical care, and not on specific accidents or injuries. In fact, our estimates of the number of injury-related medical events (1.32 per year for problem drinkers; .76 for matches) are significantly higher than rates of self-reported injury reported by survey-based studies of the general population. Hingson, *et al*,²⁰ in a survey of 1,740 employed adults in New England, found a self-reported annual rate of .22 injuries per person. Data from the National Health Survey²² indicate a per person annual rate of injury of .38 for persons ages 17–44 and .22 for persons over age 44.

There are several possible reasons for this difference. First, some injuries undoubtedly result in more than one episode of medical care, particularly in cases of serious injuries where extensive follow-up care may be required. Secondly, the number of self-reported injuries may be an underestimate of the actual number. How accurately survey respondents report injuries (usually defined as injuries requiring medical attention) occurring over the course of a year is not clear.

In the end, the observed differences between our problem drinking and non-problem drinking groups are consistent with other research. Hingson, *et al*,²⁰

found that persons whose self-reported intake of alcoholic beverages averaged five or more drinks per day had a relative risk of self-reported accidental injury of 1.7, compared with abstainers. This is quite similar to our estimate of the relative risk of injury-related medical care for problem drinkers (1.61).

Our results clearly imply that problem drinkers have either higher overall rates of injury, injuries which are more serious, or both. It is possible that the increased risk among problem drinkers is not due solely to their higher rate of alcoholic beverage consumption. Heavy drinkers may, for instance, be more likely to engage in activities which pose a greater risk of injury. It is also possible that the chronic use of alcohol impedes the process of recovery from physical injury. Additional research will be required to identify the role of these factors.

These findings provide important evidence that higher cost and utilization of medical care related to injury is associated with chronic alcohol use, supporting the view that prevention and treatment of alcohol abuse may be an important approach to reducing injury costs. □

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Jenny Labalme, Anniston Star Medical Writer, Wins 21st Annual Ray Bruner Science Writing Award

Jenny Labalme, Medical Writer for the *Anniston Star*, is the 1991 recipient of the Ray Bruner Science Writing Award, which is given annually by the American Public Health Association. Labalme was chosen for her strong investigative skills, her sense for important issues, her thorough and thoughtful coverage, and her ability to combine compassion with objectivity.

In a series of several articles, Labalme investigated length-of-stay issues at the psychiatric unit of Anniston's Regional Medical Center (RMC). Former and current employees charged that the clinic kept patients the maximum number of days their insurance would cover regardless of medical need. Labalme's stories spurred still ongoing investigations by Medicare and Blue Cross/Blue Shield. "Jenny wrote these stories before ABC's Prime Time Live followed with a similar series on other psychiatric units run by the same organization elsewhere in the nation," said Joe Distelheim, Executive Editor of the *Anniston Star*.

Since Labalme reported on the alleged insurance milking at the local RMC, Psychiatric Institute, which operates the local clinic in conjunction with RMC, has come under scrutiny by the national media and law enforcement agencies in at least three other states, with particularly serious charges of fraud being investigated in Texas.

In another of her winning entries, a story on pesticides, Labalme provided detailed information on the hazards of the 10 most widely used household pesticides and the need for

more aggressive involvement by the EPA. A story on Lay Lake carefully examined the issues surrounding a state health department's announcement to lift a ban on dioxin-tainted fish. According to Distelheim, Labalme's stories on the state's first rural AIDS clinic and the medical community's struggle to deal with their own ambivalent feelings toward AIDS patients has "stirred debate and soul-searching" among the 34,000 readers of the *Anniston Star*.

A panel of five distinguished judges selected the winner for this year's Bruner Award: Tim Friend, Health/Science Editor, *USA Today*; Maureen Mylander, Medical Editor/Writer for NIH's Office of Communications and author of *The Healthy Male—A Comprehensive Health Guide for Men*; Ronald J. Sanchez, Editor, *American Medical Writers Association Journal*; Lynn Wagner, Washington Bureau Chief, *Modern Healthcare*; and Emanuel Landau, PhD, Scientific Consultant, American Public Health Association.

The Ray Bruner Science Writing Award was established in 1971 to recognize outstanding achievement in news reporting by young journalists in the health/science/medical reporting field. It is administered by the American Public Health Association and sponsored by Lederle Laboratories, a division of American Cyanamid Company.

The award commemorates Ray Bruner, a former science editor of the *Toledo Blade* (Ohio), who dedicated much of his time during his 40-year career to encouraging young journalists to enter and excel in the science writing field.